Impact of Peri-Urban Agriculture on Food Self-Sufficiency of Faisalabad

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Introduction/ Importance of Study: Peri-urban agriculture plays a vital role in enhancing food self-sufficiency and improving nutritional outcomes, particularly in growing cities like Faisalabad, Punjab. This study assesses how it affects local production, household food supply, and stakeholder integration along the urban–rural interface.

Materials and Methods: Data were collected from 100 peri-urban farming households in Faisalabad using structured questionnaires. The survey included variables such as land ownership, crop types, agricultural income, and vegetable consumption. Additionally, land use changes from 2018 to 2023 were analyzed using GIS tools to observe the impact of urban expansion. Descriptive statistics and Chi-Square tests were applied to assess relationships between food access, nutritional perceptions, and consumption patterns.

Results and Discussion: Findings revealed that households allocated an average of 12.9 Kanals for agriculture, growing seasonal vegetables like turnip, carrot, spinach, and peas. Nearly half of the produce was consumed domestically, while the remainder was sold locally. A significant association ($p < 0.05$) was found between positive nutritional perceptions and regular access to fresh produce. However, limited government support, weak stakeholder coordination, and inadequate market access emerged as key barriers.

Conclusion: Peri-urban agriculture significantly contributes to household nutrition and food access in Faisalabad. Yet, its broader impact is limited by institutional gaps. Strengthening collaboration among farmers, policymakers, extension workers, and markets is essential for making peri-urban agriculture more resilient and sustainable in urban Pakistan.

Keywords: Peri Urban Agriculture, Food Security, Food Access, Food Self-Sufficiency, Nutrient-Rich Crops, Urban Planning, Nutritional Impact.

Introduction:

Urban agriculture comes with unique features based on the socioeconomic, topographical, and political context of the local area. Luc Mougeot created the definition of Urban Agriculture that is most frequently used [1]. He defined urban agriculture as an industry that grows and raises, processes, and distributes a variety of food and non-food products while primarily reusing the human and material resources, goods, and services found in and around that urban area. In turn, this industry primarily supplies the human and material resources, goods, and services to that urban area. He did this by using the technical criteria of the Urban Agriculture [2]. Throughout the world, urban agriculture is a prime example of a food system component with little or no laws currently in place. Urban planners have been pushing for the inclusion of Urban Agriculture in plans for urban planning for the past few decades. Research conducted in high, middle, and low-income nations on urban gardens indicates that they have an impact on a number of nutrition and food security outcomes [3]. Urban green areas that actively involve people improve people's physical and mental health, lessen social and economic issues, and strengthen communities [4].

The importance of food security varies periodically and between countries. Food security is a complex phenomenon that incorporates a variety of demographic, social, and economic elements. Its importance can change over time and across different nations, regions, and social groups. Food insecure families can exist in food self-sufficient nations due to uneven distribution of food throughout the nation. For instance, Pakistan achieved and continues to sustain food self-sufficiency in the 1980s, but a significant section of its population 26% is undernourished [5]. In a city with a long history of agriculture, urban agriculture may significantly reduce malnutrition and increase food self-sufficiency. It can also provide important insights for urban planning and nutrition policies, not only in Pakistan but in other rapidly urbanizing areas throughout the world [6]. The influx of housing estates has resulted in altering land uses in Faisalabad's Peri-Urban regions, which in turn has affected the insecurity of the food supply. Arable land in Faisalabad has been lost as a result of small farms being converted into residences, shops, and factories. Therefore, with the growth of urban regions and industrial output, agricultural land, especially in Peri-Urban areas, is expected to confront resource provisioning (land and water). Also, farmers think monocultures are more productive than integrated crops because of capitalism. Peri-Urban agriculture is therefore vulnerable to the possibility of disappearing, which would increase food insecurity [7].

In the research on the demand side of food security, the relationships between living standards, family assets, and agricultural endowments are well established. For instance, it was verified by [8] demonstrated food insecurity was prevalent in France and that it was correlated with socioeconomic traits, living circumstances, and dietary quality. They discovered that national nutritional policy ought to take food accessibility both geographically and financially into account. The influence of socioeconomic attributes on the circumstances surrounding food security was investigated by [9]. The majority of US households enjoyed food security, with just 8% experiencing extremely low food insecurity, according to analysis of the National Health and Nutrition Examination Survey 2007–2008. [10] applied logistic regression and descriptive statistics to the Ghanaian survey data, demonstrating that access to farm credit, farm acreage, size of the household, and income earned outside the farm all had a substantial impact on household food security. They supported the presumptive findings that bigger households had higher levels of food security. In the context of food security, the importance of household wealth, education, and occupation was proven by [11] in a survey using a national representative sample. They concluded that a more diverse diet and higher calorie consumption were linked to women's empowerment. By means of an assessment carried out among college attendees, [12] demonstrated the significance of resources, skill development, and financial standing and

referred to them as adequate food resources. Comparable outcomes were discovered in Nigeria by [13].

[14] studied that food insecurity was common in many developing nations in the 1970s, even though there was an abundance of food and it was moderately priced. Individuals' situations regarding food consumption and use were influenced by a variety of socioeconomic and geographic factors, which differed throughout countries and regions [15]. Growing numbers of homes are consuming vegetables grown in cities, urban farming is becoming more popular, and unused land is being recovered for gardening [16][17][18][19][20]. Dramatic increase in the population is causing the environment deterioration, there is a shortage of resources, food is distributed unevenly, and there are several cases of starvation. Therefore, a revolution in urban agriculture is required to address the issue of hunger and the scarcity of food [21]. People these days tend to prefer eating less healthy, manufactured food that is readily available. Nutrition insecurity are induced by dietary choices, preferences, and lifestyle decisions [22].

Urban farming should be considered as a means of achieving sustainable growth in the cities like Faisalabad that continue to grow. Urban agriculture is necessary for the world to become food self-sufficient. Incorporating farming into urban development can improve land usage, save transportation expenses, and assist communities in adapting to challenges such as economic downturns and climate change. Developing resilient, productive, and sustainable agriculture is a key challenge facing humanity today in the context of climate change, degradation of the environment, and rising food demands [23]. A viable solution to better address this problem is to explore regionalizing food systems and enhancing food self-sufficiency [24], as well as food security in the present and the future, especially in view of the continued urbanization [25][26]. Personal ties among the different links in short food supply chains such as farmer shops within a particular geographic area are a common characteristic of regional food systems [27] or within a hundred km surrounding large cities [28]. It has been suggested that shorter supply chains for food, or the distance between agricultural production and consumption, could result in fewer food miles and a potential reduction in greenhouse gas (GHG) emissions, and food waste [29][30]. Due to the support provided by regional agricultural activities, local suppliers, services, and financial flow, regional economic structures can be strengthened [31]. Furthermore, consumers' awareness of the social, economic, and environmental effects of their food choices may rise as a result of the intimate relationship between production and consumption and bring about more production process transparency [24]. Furthermore, increased land demands brought on by wasteful and inefficient land usage may make local food systems less sustainable [32].

The precise contribution of peri-urban agriculture to food self-sufficiency in cities like Faisalabad is still little understood, despite the fact that many studies have addressed the role of socioeconomic variables in determining food security in both developed and developing nations. The majority of the work now in publication ignores urban and peri-urban dynamics in favour of concentrating on more general national trends or rural food systems. Additionally, little is known about the roles played by local food production stakeholders, including small-scale farmers, vendors, and city planners. In order to fill these gaps, this study looks into the local dynamics of peri-urban agriculture, how it fits into the food supply chain, and how it affects the lives and nutrition of the urban population of Faisalabad.

This study aims to assess the scale and practices of peri-urban agriculture in Faisalabad by examining how food is produced in urban and peri-urban zones and identifying the types of crops grown, farming techniques used, and available resources. It further seeks to analyze the contribution of this agriculture to the local food supply, particularly in terms of enhancing food self-sufficiency and improving the nutritional status of the population. Through evaluating the integration and roles of various stakeholders such as farmers, local authorities, and private organizations the study also explores the level of coordination in food production. Additionally,

it aims to identify key challenges faced by peri-urban farmers, such as land loss, resource limitations, and policy gaps, and to recommend targeted policies and planning strategies that can strengthen urban food systems and promote sustainable self-sufficiency in Faisalabad.

Objectives:

The objectives of the study are:

To find out about the urban agricultural food production in Faisalabad.

To investigate the urban agricultural food impact on food self-sufficiency and nutrition of local population.

To find out the integration of stakeholders involved in urban agricultural food production.

Research Methodology:

Materials and Methods:

Study Area:

Faisalabad is situated in Punjab province with latitude and longitude 73° E-74° E and 30° N-31.15° N. In surroundings, its boundary is connected with Jhang, Sahiwal, Toba Tek Singh, Hafizabad, Okara and Sheikhupura. Due to its industrial perspective and being a second biggest industrial city of the country, it is called Manchester of Pakistan, which was previously known as Lyallpur, was established as Mandi town in 1805 as a part of program of colonization of west Punjab. Lyallpur was named after Sir James Lyall, then Lt. Governor of the Punjab 1887-1892 [33][34]. In 1904, when Faisalabad city was established under British rule, its aerial extent was only 5.8 sq. km. Currently, Faisalabad city constitutes the area of 213sq.km while its metropolis extent is 1295 sq.km [35]. Faisalabad is located in upper portion of the Indus plain between Chenab and Ravi River. The summer and winter temperatures are 50°C and -1°C, respectively, with an average annual rainfall of around 550 mm [36]. In Faisalabad, rainfall does not occur throughout the year, most of the rainfall occurs in two seasons namely summer, from July to September and winter, from December to March. Winter rainfall accompanies the western disturbances. A small quantity of rainfall occurs during thunderstorms (dry summer & calm interval). The climate of the whole planet earth is in transition.

Table 1. Geography and climate of Faisalabad

Cultivated Area	316,815
Population	3,800,000, 2.4%
Total number of villages	842
average annual rainfall	550 mm
Climate	Semi-Arid
Altitude	184 meters (604 feet)

Survey Locations:

The survey was conducted in surrounding areas of four major roads: Jhang Road, Samundri Road, Jaranwala Road, and Sargodha Road.

This map shows the defined study area in Faisalabad, which includes the city center and the peri-urban areas around it. The research area's boundaries, which include the periphery where peri-urban agricultural activity is most prevalent, are shown by the outside black line. The formal city border, which separates peri-urban and urban districts, is shown by the inner black line. In order to guarantee spatial variety, surveyed locations are indicated by red triangles that have been carefully chosen from various zones. In order to contextualize the accessibility and connectivity of the area, major highways and trains are provided.

Sampling:

The sampling method employed was non-probability snowball sampling locations [37][38]. Initially, a few known peri-urban farmers were identified, who then helped in referring to other participants. The sample size was determined using Yamane's formula (1967) for a

finite population [39][40]. A total of 100 respondents were selected, considering feasibility, accessibility, and representation from different peri-urban areas of Faisalabad.

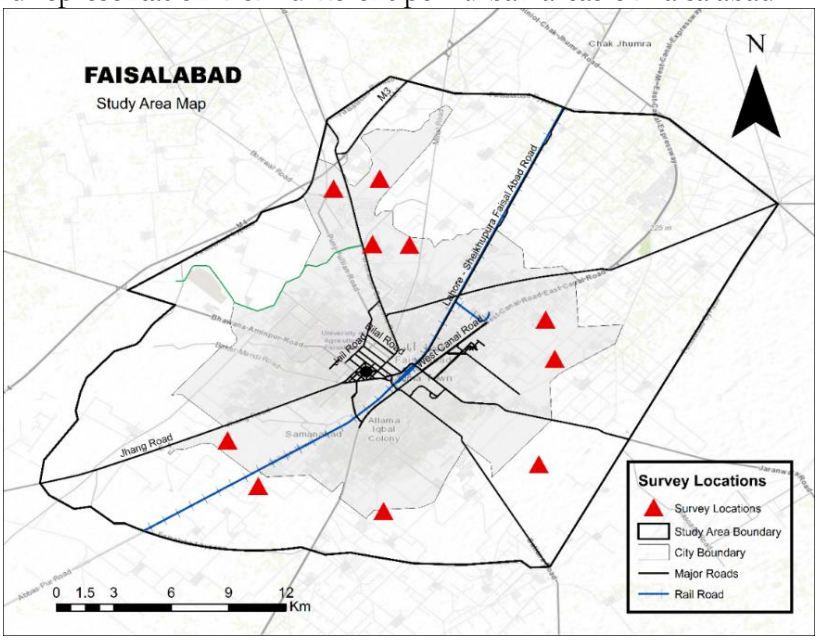

Figure 1. Study Area Map (Faisalabad)

Research Design:

The research was designed and explained in the form of a flowchart diagram.

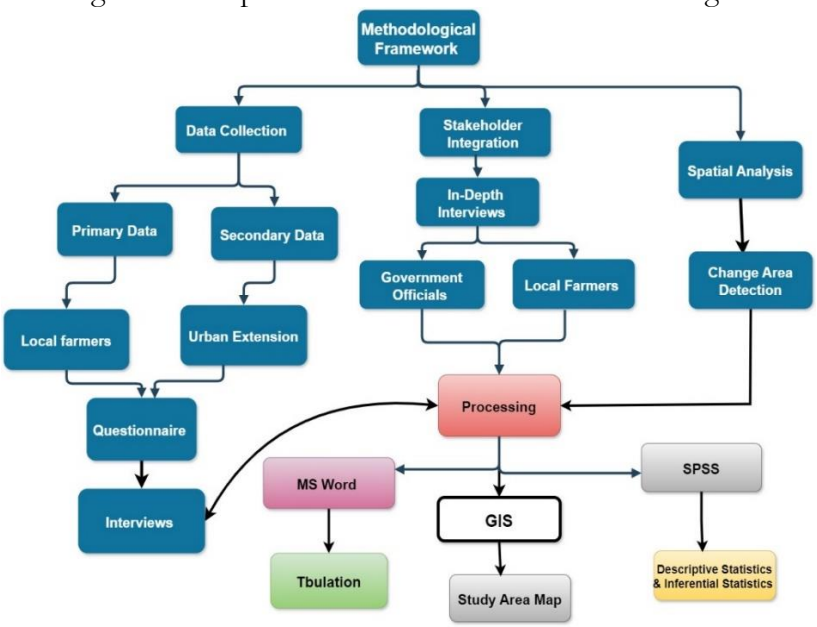

Figure 2. Flowchart diagram representing research design

The primary and secondary data was collected on household respondents' consumption patterns as well as agricultural output and production of selected farmers from randomly chosen villages. Every piece of gathered data statistically analyzed.

Data Collection:

To investigate the effect of Peri-Urban agriculture on food self-sufficiency, Faisalabad, the third-largest city in Pakistan in terms of population, was selected as a case study. With many canals supplying irrigation to fertile land, the study area is level and ideal for agricultural operations. Due to its proximity to Faisalabad via important routes, agricultural land is frequently developed into residential areas. The study focused on 10 Peri-Urban villages. The main

cropping seasons are Rabi (winter) and Kharif (summer). While summer crops like vegetables, cotton, rice, fodder maize, and sorghum are planted during Kharif (April–September), winter crops like vegetables, wheat, sugarcane, and berseem are grown during Rabi (October–March) [41].

Table 2. Botanical names of different major crops which Faisalabad city is cultivating [41]

Common name	Botanical name
Wheat	Triticum aestivum
Sugarcane	Saccharum officinarum
Cotton	Gossypium hirsutum
Sesame	Sesamum indicum
Cauliflower	Brassica oleracea
Spinach	Spinacia oleracea
Tomato	Solanum lycopersicum
Radish	Raphanus sativus
Carrot	Daucus carota
Ladyfinger	Abelmoschus esculentus
Cluster beans	**Cyamopsis tetragonoloba**
Bitter gourd	Momordica charantia
Onion	Allium cepa
Peas	Pisum sativum

The field survey, farmer interviews, and household questionnaires all included the following information: A survey aimed at finding out what kinds of crops local farmers are growing, what farming practices they are using, and how much crop they are currently producing carried out. Preliminary information from the agricultural extension department to find out the target areas of urban agriculture production. In order to comprehend the influence of urban agriculture on food self-sufficiency and nutrition, interviews regarding urban agricultural practices undertaken with local inhabitants, urban farmers, and community leaders. The research employed a blend of primary and secondary data sources, such as academic publications, government papers, and records from local organizations.

The main components of food accessibility were evaluated using a standardized data recording form in conjunction with in-depth interviews with producer groups: An aspect of production that addressed the features of communal farming, such as land ownership, the kind of crop, its amount, quality, price, seed source, profit margin, and production expenses. Consumption culture encompasses various aspects such as the type and quantity of food consumed, the amount borrowed or shared, the style of living concerning natural resources, marketing, income/expenses, and savings. Information about how food is used includes locals' production and consumption patterns. The home respondents reported their food acquisition patterns and the data gathered utilizing a questionnaire and a record-keeping form. Networking Among Stakeholders and Institution Building: Surveys and interviews done with these parties to learn more about their contributions, difficulties, and roles in urban agriculture. Relationship between stakeholders, government officials and local farmers carried out through in-depth interviews.

Tools and Techniques

For spatial analysis, ArcGIS 10.8 was used to prepare maps and analyze land use/land cover (LULC) changes. Landsat imagery (2015, 2018, and 2023) was downloaded from USGS and processed using Google Earth Engine to extract NDVI and perform change detection. Raster data was converted to vector format using the Raster to Polygon tool, and zonal statistics were applied to detect agricultural land changes. Statistical analysis was conducted using MS Excel and SPSS v25, including descriptive statistics, chi-square tests, ANOVA, and regression

analysis to explore the relationship between socioeconomic factors and peri-urban agriculture's impact on food self-sufficiency in Faisalabad.

Results:

Demographic Profile:

Age Distribution of Farmers' Household Head:

The age distribution of the heads of farmers' households in Faisalabad provides important insights for Peri-Urban agriculture.

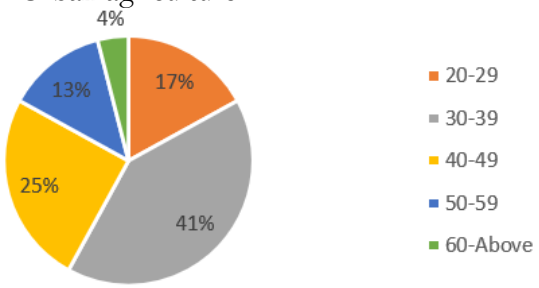

Figure 3. Graph representing Age of Farmers Households Head

Above graph shows that the age distribution of farmer's household heads in Faisalabad shows that 41% fall within the 30-30 age group, indicating that many are in their prime working years and open to new agricultural practices. Younger farmers (20-29 years) account for 17%, bringing creativity and energy, while 25% of farmers aged 40-49 contribute valuable experience. Only 4% are 60 or older, suggesting most transition to less demanding roles as they age.

Annual Agricultural Income:

The association between household structure and agricultural income was investigated using a chi-square test and a cross-tabulation. The aim of this study was to determine if the yearly agricultural incomes of single and mixed family systems differ significantly.

Table 3. Annual agriculture income of the single and combined family

Cross tabulation	x^2	P
Pearson chi square	54.132	0.001

The Chi-square test results (x^2= 54,123, $p<0.001$) indicates a highly significance association between family structure (single vs. combined) and income category, showing that combined family structures are more likely to fall into higher income categories than single family structures. The chi-square test shows a significance difference in yearly agricultural revenue between single family and combined family structures. Combined families have more income diversity and higher earnings, especially in the 55,000-70,000 and 100,000 brackets while single families are mostly in lower income groups. This suggests that combined families may have more resources and better income prospects compared to single family households.

Household Income Expenditures:

Income Expenditures on Health, Education and Food:

According to the data, the majority of respondents (46) allocate between 20 and 40 percent of their income to health care, making this the most typical spending range. Thirteen respondents devote only 0–20% of their money to health, whereas a smaller group of thirty-five pays 40–60%. Remarkably, only 5 respondents devote 80–100% of their total spending to health-related costs. This distribution shows that although health expenses account for a substantial portion of most respondents' budgets, very few spend more than they should.

The distribution of farmers' revenue towards education. Forty-two farmers fall into the category of those who spend between forty and sixty percent of their income on schooling. The 20–40% range, where 34 farmers distribute their revenue, comes next. Twenty-two farmers, in a smaller sample, allocate between 0% and 20% of their revenue to schooling. Remarkably, just one farmer devotes between 80 and 100 percent of their income to education, demonstrating how few farmers devote such a significant amount of their finances to educational costs.

The farmers divide their take home pay for food. The majority of farmers (44) indicate a modest spending as they spend 20–40% of their income on food. Less farmers (27) spend between 0 and 20%, which might indicate cheaper food or more money being spent elsewhere. Another group (28) has larger food expenditures, allocating 40–60% of their income to food. No farmer spends eighty to one hundred percent of their earnings on food, meaning that no one devotes a disproportionate amount of their earnings to this expenditure.

Investigation of Food production in Faisalabad:

Involvement and land ownership:

Peri-Urban agriculture is practiced by all 100 respondents (100%), demonstrating its vital significance in their lives and food self-sufficiency in Faisalabad. This full involvement highlights the significance of Peri-Urban agriculture and recommends emphasizing its effects on crop kinds, household income, and socioeconomic advantages.

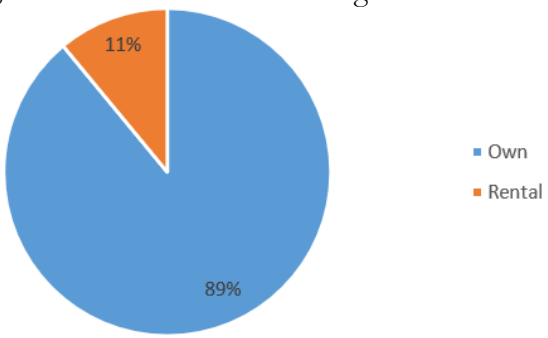

Figure 4. No. of farmers having own land vs rental land

All 100 respondents are engaged in Peri-Urban agriculture, according to the cross-tabulation table, with 89 of them owning the land they cultivate and 11 of them renting it. This shows that the majorities own their land (89%) and just a lesser percentage (11%) rent it. The case processing summary guarantees a complete dataset for analysis by verifying the validity of each of the 100 instances and removing any missing data. The data demonstrates the respondents' widespread participation in Peri-Urban agriculture, with a sizable majority of them being landowners. Its consistent acceptance by both landowners and renters is emphasized by the absence of heterogeneity in engagement, which is important for comprehending the dynamics of Peri-Urban agriculture in Faisalabad.

Cropping Pattern:

Data on the crops grown by Faisalabad's peri-urban farmers was gathered in order to comprehend their agricultural priorities.

Table 4. Crops cultivated in Peri-Urban areas of Faisalabad

Dominant Crops	Respondents
Vegetables	51%
Wheat	26%
Sugarcane	15%
Herbs	4%
Sesame	3%
Fruits	1%

The frequency table displays the variety of crops that Faisalabad's Peri-Urban farmers cultivate: 51% of farmers cultivate vegetables, 26% wheat, 15% sugarcane, 4% herbs, 3% sesame, and 1% fruits. Vegetable production is predominant, indicating that it is important for food self-sufficiency, dietary diversity, and nutritional security. As cash and staple crops, wheat and sugarcane make major contributions to both food security and economic stability. Though less prevalent, the presence of fruits, herbs, and sesame indicates the production of specialty crops that can increase revenue and diversify agricultural output.

Summer and winter vegetables:

The following table lists the main summer and winter vegetables that peri-urban farmers in Faisalabad cultivate in order to demonstrate seasonal agricultural trends.

Table 5. The variety of summer and winter vegetables cultivated by Peri-Urban farmers in Faisalabad

Summer Vegetables	Scientific Names	Responses	Winter Vegetables	Scientific Names2	Responses
Ladyfinger	Abelmoschus esculentus	42%	Mustard	Brassica juncea	29%
Round Gourd	Benincasa fistulosa	10%	Carrot	Daucus carota	16%
Bitter Gourd	Momordica charantia	14%	Turnip	Brassica rapa	12%
Tomato	Solanum lycopersicum	4%	Reddish	Raphanus sativus	15%
Cluster Beans	Cyamopsis tetragonoloba.	6%	Cauliflower	Brassica oleracea	11
Brinjal	Solanum melongena	12%	Spinach	Spinacia oleracea	6%
Sponge Gourd	Luffa cylindrica	12%	Garlic	Allium sativum	6%
			Peas	Pisum sativum	5%

The most common summer vegetable, planted by 42% of respondents, is ladyfinger. Other prominent crops include bitter gourd (14%), brinjal (12%), and sponge gourd (12%). This variety reflects efforts to maintain dietary diversity and underscores the significance of Peri-Urban agriculture in enhancing food self-sufficiency and economic stability. According to the frequency table for winter vegetables, 29% of respondents' plant mustard, making it the most prevalent vegetable. Carrot (16%) and Reddish (15%) are additional high-ranking vegetables; turnip (12%) and cauliflower (11%) are noteworthy additions. Peas are cultivated at a rate of 5%, while garlic and spinach are grown at 6% apiece. This varied farming emphasizes how crucial winter veggies are to Peri-Urban agriculture's food security and variety of diet.

Peri-Urban Agricultural Challenges:

It is crucial to comprehend the main obstacles peri-urban farmers encounter in order to increase agricultural output and guarantee sustainability over the long run.

Table 6. Challenges faced by Peri Urban Farmers

Crop Production challenges	Responses
Limited Space	48%
Water Scarcity	25%
Access to Quality Inputs	15%
No Pest Disease Management	4%
Lack of Knowledge or Training	4%
None of These	4%

Notwithstanding, the farmers encounter noteworthy obstacles, as 48% of the respondents are affected by restricted space, and 25% are affected by water shortage. For 15% of farmers, obtaining high-quality inputs is another obstacle. A lesser percentage of respondents were impacted by less typical problems such inadequate knowledge or training and managing pest diseases. Ensuring the productivity and sustainability of Peri-Urban agriculture in

Faisalabad, as well as improving food self-sufficiency, requires addressing these issues via focused policy interventions and support initiatives.

Crop Distribution Patterns:

The peri-urban farmers' primary marketing channels are shown in the following table to help you understand how they reach markets and distribute their goods.

Table 7. Distribution of responses showing the various marketing channels through which peri-urban farmers sell their produce

Marketing Challenge	Responses
Local Farmers Market	63%
Direct Sales to Neighbors	32%
Through Retailers or Wholesalers	4%
Selling and Purchasing from Dealers	1%

According to the frequency table for marketing channels, 63% of Peri-Urban farmers in Faisalabad sell their produce in neighborhood farmers' markets. This is a significant majority of farmers. This suggests that local markets are an important channel of distribution that help the community economy and local food self-sufficiency. Furthermore, 32% of respondents sell their goods to their neighbors directly, which strengthens links within the community and can increase profitability by lowering the need for middlemen. Just 4% of farmers use merchants or wholesalers, indicating that smaller-scale or less resource-rich farmers are less likely to use this more formal market route. The low usage of dealers, at just 1% of respondents, is probably the result of restricted access or a preference for more direct marketing techniques.

Results on perception:

Accessibility:

The advantage of eating locally grown food is seen differently by the public depending on their access to fresh produce, as shown in the figure below.

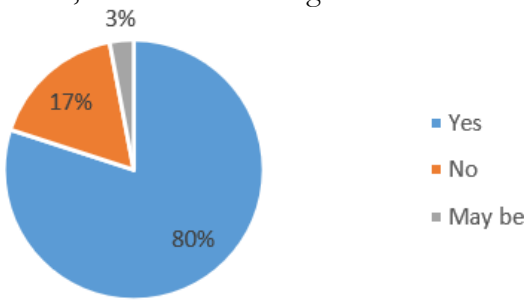

Figure 5. Perception of locally grown food benefits based on their access to fresh produce

Participants' perceptions of the advantages of eating locally farmed food were strongly impacted by their ability to access fresh produce. 80 percent of those surveyed said they had access to fresh food, while 17 percent, mostly from inner cities, said they had little or no access, especially to fresh vegetables. Furthermore, 3% of individuals provided ambiguous answers, indicating that they had uneven access to fresh fruit. These results imply that although views of the advantages of local food are significantly influenced by availability, other social and geographical aspects also need to be taken into account. This emphasizes how crucial coordinated approaches are to improving Faisalabad's food self-sufficiency

Food Expenses:

The perspectives of respondents regarding the affordability of food in connection to the contribution of urban agriculture to household food costs are examined in the figure below.

Important viewpoints on how people perceive the connection between urban agriculture and their capacity to pay for food expenses are revealed by the responses. 61% of respondents said they could control their food expenses, according to the results, indicating a favorable relationship between perceived food security and financial capability. In contrast, 23% had no

opinion, demonstrating a lack of confidence in the advantages of urban gardening as well as the affordability of their own food. About 5% firmly believed they could handle meal bills, while 9% disagreed and had concerns about paying for them. Just 2% of respondents strongly disagreed with the assertion, indicating both financial hardship and doubt about the contribution of urban agriculture to food security. These answers demonstrate the complex interplay between views of the advantages of eating locally sourced food and financial capability.

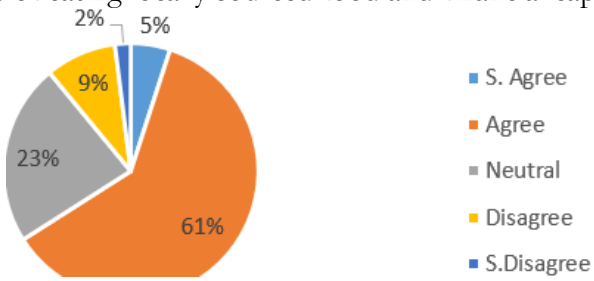

Figure 6. Perception of food affordability in relation to urban agriculture

Health and Local Food:

To evaluate the perceived health effects of eating local food, the respondents stated wellbeing improvements are shown in the accompanying figure.

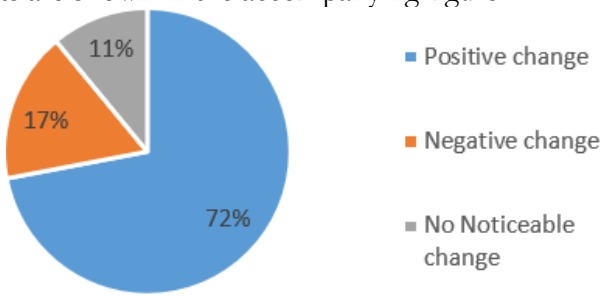

Figure 7. Changes in health from consuming locally grown food

Among the 100 respondents, 72 said that eating food that was farmed nearby improved their wellbeing. 11 participants, however, saw no discernible change, while 17 participants reported negative changes. These answers demonstrate a broad trend among respondents toward the idea that eating locally produced food has more health advantages.

Dietary Lacks:

Table 8. Factors Associated with Diet Deficiency in Families of Peri-Urban Farmers

Aspect of Diet	Responses
Protein	41%
Fruits & Vegetables	25%
Healthy Fats	15%
Vitamins	5%
Fiber	9%
Carbohydrates	5%

The most often deficient nutritional component, according to the analysis of diet-related features lacking in the families of Peri-Urban farmers, is protein, which was identified as lacking in 41.0% of respondents. A deficiency in fruits and vegetables follows, as reported by 25.0% of respondents. Furthermore, 9.0% of respondents mentioned a lack of fiber, and 15.0% claimed a shortage in healthy fats. Vitamin and carbohydrate shortages were reported by respondents in lower percentages (5.0% and 5.0%, respectively). These results point to serious dietary deficiencies in the Peri-Urban farming families' diets, with the most common deficiencies being in fruits and vegetables and protein. By filling in these gaps, specific nutritional interventions may be made to help these families eat better.

Support Perception:

The most often reported dietary deficiencies are shown in the following table to help identify the main nutritional issues among peri-urban families.

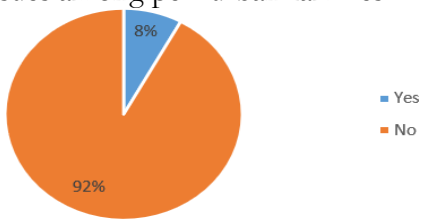

Figure 8. Government/NGO Support for Peri-Urban Agriculture

Government/NGO Support for Peri-Urban Agriculture and Current Involvement in Peri-Urban Agriculture shows that all respondents were either involved in Peri-Urban agriculture at the time of the analysis or did not receive any support from these organizations, and their current involvement in this field is distributed similarly. To be precise, Peri-Urban agriculture is now being practiced by 8 respondents who got help and not by 92 respondents who did not get support. Due to the distribution's perfect alignment with expectations, a Pearson Chi-Square was produced, which shows that there are no new insights or variances since the replies' "Current Involvement in Peri-Urban Agriculture" remains constant. As a result, it was not possible to conduct any statistical tests for this variable, indicating that there is little variation in the present engagement status in relation to government/NGO sponsorship.

Change Area Detection:

To analyze the progression of urbanization, LULC data was divided into two periods: 2015–2018 and 2018–2023, highlighting early and recent trends respectively.

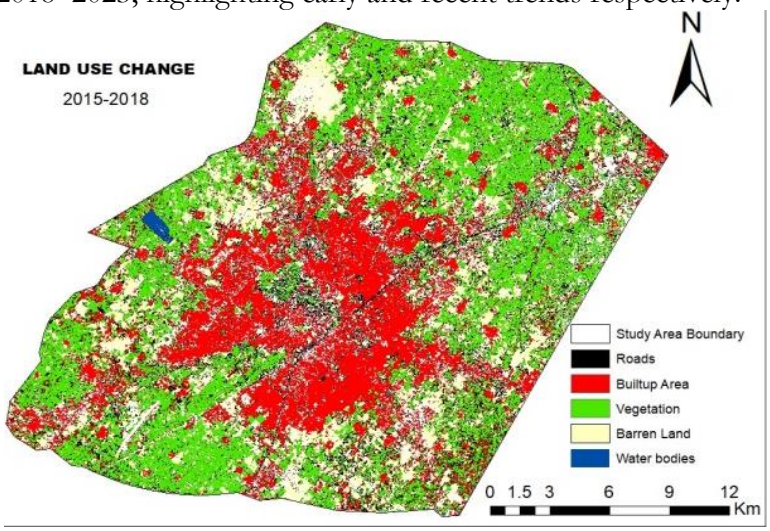

Figure 9. Land Use Change (2015-2018)

According to LULC statistics from 2015 to 2018, 42% of the area is covered by vegetation, 30% is made up of built-up area, 18% is made up of barren land, and 10% is made up of roads. Although natural vegetation predominates, there is a noticeable human influence due to road networks and urbanization, indicating a balance between the natural and built areas.

LULC 2015-2018

Table 9. LULC statistics 2015-2018 (Supervised Classifications)

Barren Land	76920158.11	18%
Built-up Area	138773518.2	30%
Roads	63561126.98	10%
Vegetation	182338561.1	42%
Grand Total	523065315.6	100%

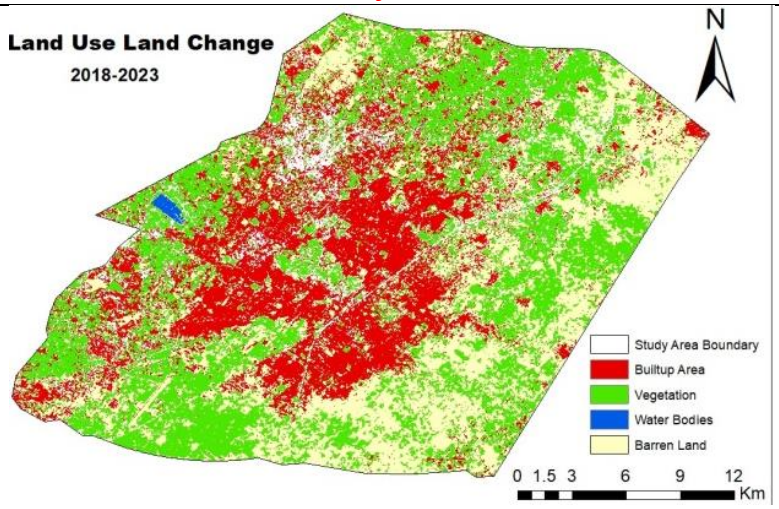

Figure 10. Land Use Change (2018-2023)

LULC 2018-2023:

Table 10. LULC statistics 2018-2023 (Supervised Classifications)

Barren land	154.0857202	29%
Built-up area	142.7685242	35%
roads	53.68779715	10%
vegetation	186.1210935	26%
Grand Total	537.7929935	100%

Significant urbanization is shown by LULC data, which reveals that 35% of the study region is made up of built-up areas. A combination of built and natural areas makes up 26% of the vegetation, with the remaining 29% being made up of barren terrain. Roads facilitate regional connection, making up 10% of the area. Only 0.2% of the land is made up of water bodies. In general, there is little natural vegetation and scarce water supplies due to human activity dominating the environment.

Discussion:

Demographics, Landownership and agricultural focus

This study examined how peri-urban agriculture in Faisalabad contributes to food self-sufficiency by examining a number of social, agricultural, and environmental parameters. 89% of farmers own the land they cultivate, indicating the widespread use of peri-urban agriculture. The majority of farmers are between the ages of 30 and 39. Vegetables are the main crop, and both summer and winter types provide substantial contributions to household nutrition. Despite ongoing obstacles like space and water scarcity, the majority of farmers market directly to consumers locally and report having a moderate amount of control over food costs.

Household structure, Income and Expenditure

As per the demographic profile, 41% of household heads are between the ages of 30 and 39, with 25% coming after them. The farming population is energetic and adaptable due to this age distribution. The large percentage of vegetables produced (51%) indicates a focus on high-nutrition, short-cycle crops appropriate for urban boundaries, while the majority land ownership (89%) guarantees more consistent agricultural techniques. In contrast to single-family households, the data also shows that mixed family structures typically fall into higher agricultural income groups. Shared resource management and labor pooling may be to blame for this. Additionally, the majority of respondents devote a sizeable percentage of their income to food (20–40%), education (40–60%), and health (20–40%), indicating balanced but tight household budgets.

Cropping Patterns, Nutrition and Food Access

Dietary diversity is highlighted by cropping patterns: the most popular summer and winter vegetables are carrots, ladyfinger, mustard, and brinjal. These crops contribute to market supply in addition to supporting domestic consumption. But the two biggest obstacles were water shortage (25%) and inadequate space (48%). Despite this, peri-urban agriculture promotes local economies and food availability, as seen by the high preference for direct neighbor sales (32%) and local farmers' markets (63%). It is disturbing that, considering the high rates of vegetable production, the most prevalent shortages among agricultural households, according to diet-related statistics, are protein (41%), and fruits and vegetables (25%). This discrepancy raises the possibility that either food is sold instead of eaten or that there is a lack of dietary awareness. Only 8% of respondents said they had received government or NGO help, indicating a large institutional support gap.

Access to Fresh Food and Perceived Notional Impact

Just 17% (mostly from inner cities) reported difficulties getting fresh food, compared to the majority (80%) who said they had sufficient access. Although a minority (9%) disagreed, the majority (61%) believed they could control their food expenses, indicating financial vulnerability. Peri-Urban agriculture may have a favorable impact on nutritional health, as 72% of respondents said eating locally produced food enhanced their well-being, while 17% reported adverse effects.

Land Use Change and Urban Pressure

The conflict between urban growth and agricultural land is highlighted by Land Use and Land Cover (LULC) studies from 2015–2023. While vegetation fell from 42% to 26%, built-up areas increased from 30% to 35%. The viability of peri-urban food systems may be threatened if urban encroachment on agricultural areas is not controlled, as indicated by this pattern.

Overall, the results confirm that Faisalabad's peri-urban agriculture plays a major role in local food security and food self-sufficiency. However, problems including inadequate institutional support, land pressure, food shortages, and infrastructure constraints need to be addressed. Land protection, access to high-quality inputs, and educational initiatives on sustainable farming and nutrition should all be supported by policy. The contribution of peri-urban agriculture to the development of resilient urban food systems might be further strengthened by expanding market access, especially for women and smallholders.

Conclusion and Recommendations:

In order to guarantee a steady and dependable food supply for the populace, food self-sufficiency is essential. In order to increase local food production and lessen reliance on outside supplies, the research has identified a number of crucial areas that require attention and assistance. Urbanization has reduced the amount of agricultural land available for farming, which has decreased local food production and increased reliance on food imports from neighboring regions. Promoting Peri-Urban agriculture is essential to increasing local food production and addressing Faisalabad's food security issues. To minimize the use of chemicals and improve food safety, local governments should encourage and promote crop development, placing a special emphasis on organic agricultural methods. To encourage sustainable agriculture methods, farmers should have access to organic farming inputs, training programs, and technical support.

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